Plexuses

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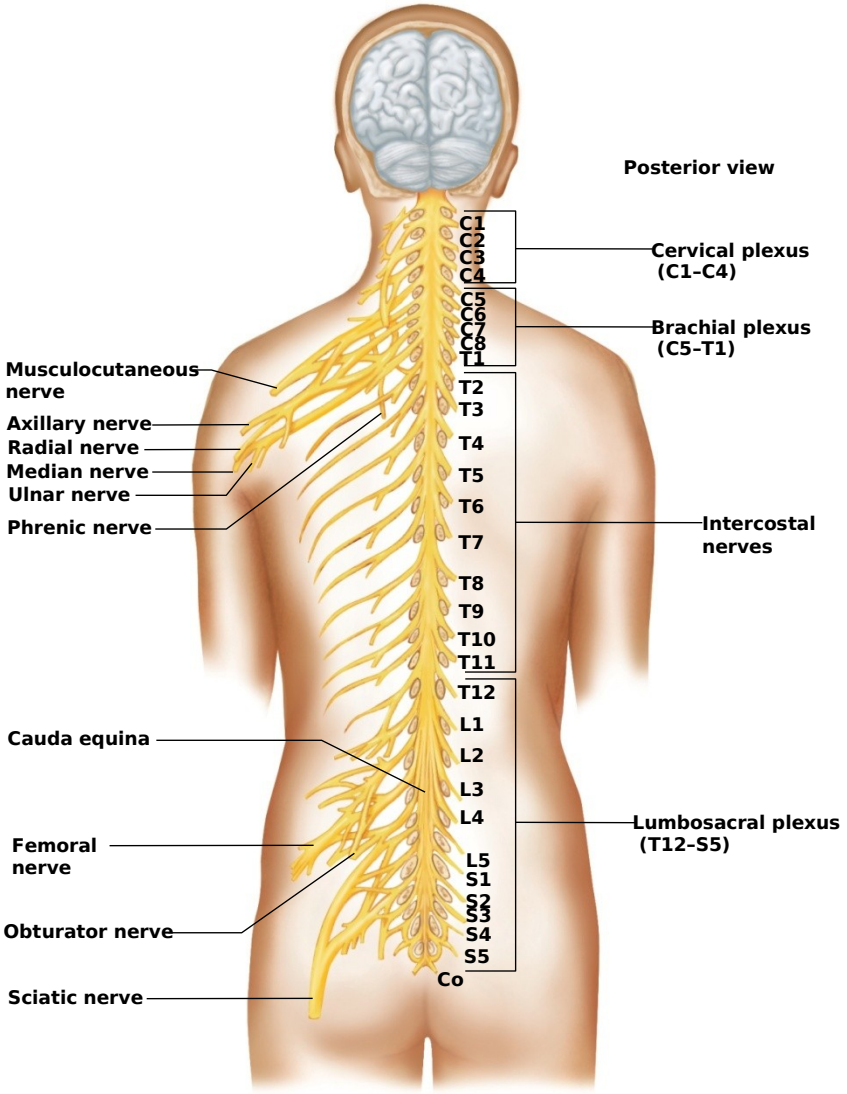

11.7: Autonomic Nervous System

Functions without conscious effort
Controls visceral activities
Regulates smooth muscle, cardiac muscle, and glands
Efferent fibers typically lead to ganglia outside of the CNS

- Two autonomic divisions regulate:
  - Sympathetic division (speeds up)
    - Prepares body for ‘fight or flight’ situations
  - Parasympathetic division (slows down)
    - Prepares body for ‘resting and digesting’ activities

Autonomic Nerve Fibers

- All of the neurons are motor (efferent)

- Preganglionic fibers
  - Axons of preganglionic neurons
  - Neuron cell bodies in CNS

- Postganglionic fibers
  - Axons of postganglionic

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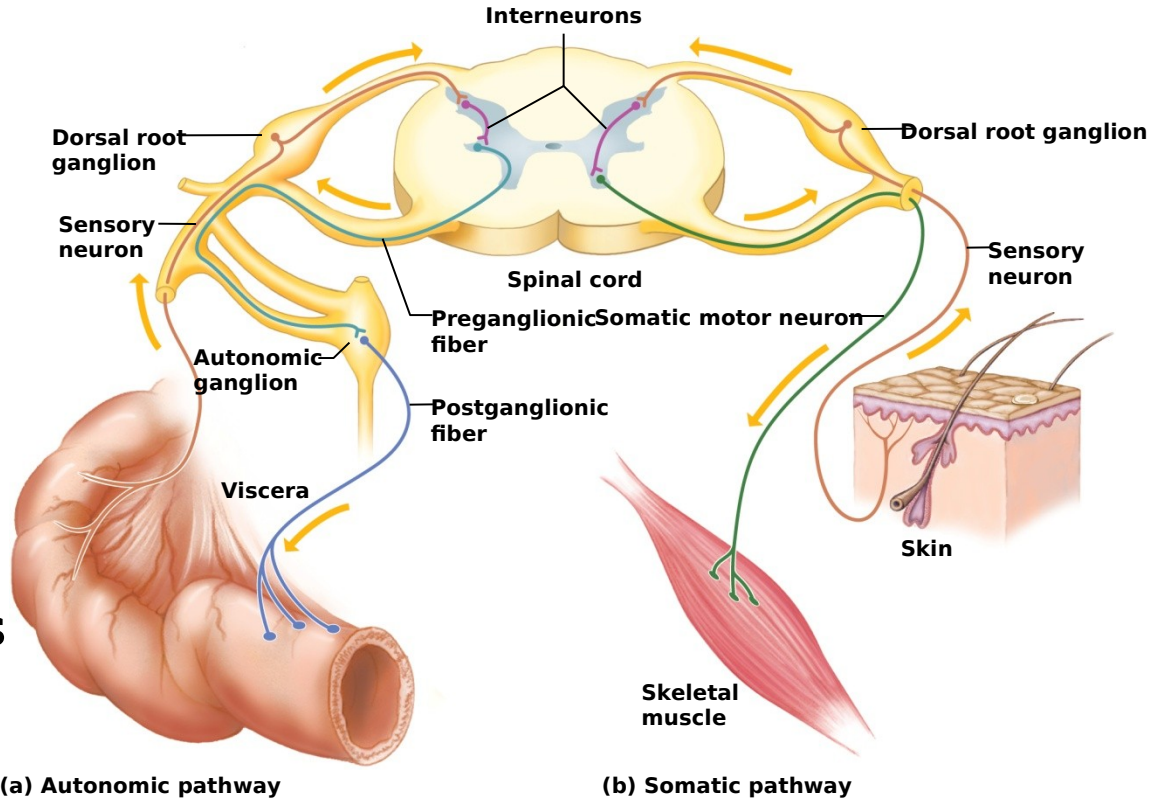

Sympathetic Division

- Thoracolumbar division – location of preganglionic neurons

- Preganglionic fibers leave spinal nerves through white rami and enter paravertebral ganglia

- Paraverterbral ganglia and fibers that connect them make up the sympathetic trunk

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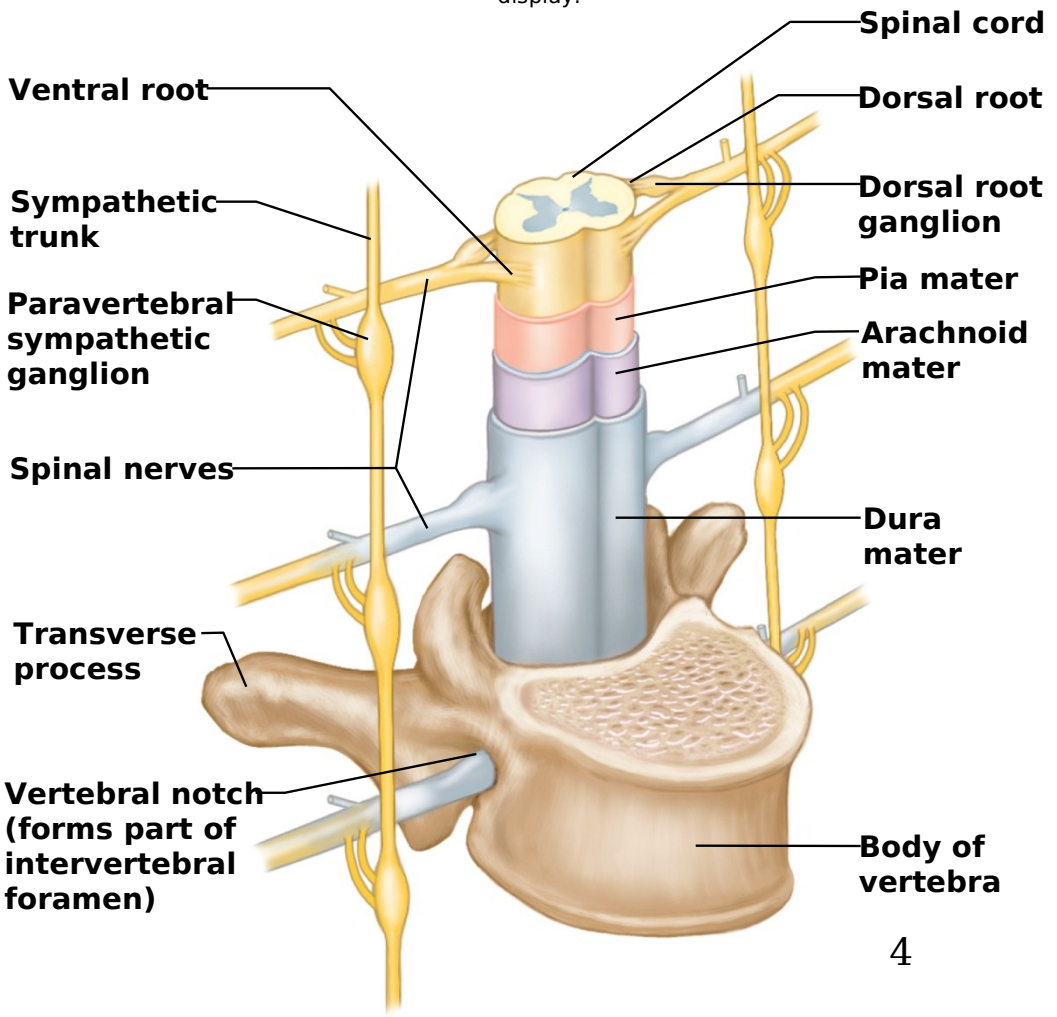
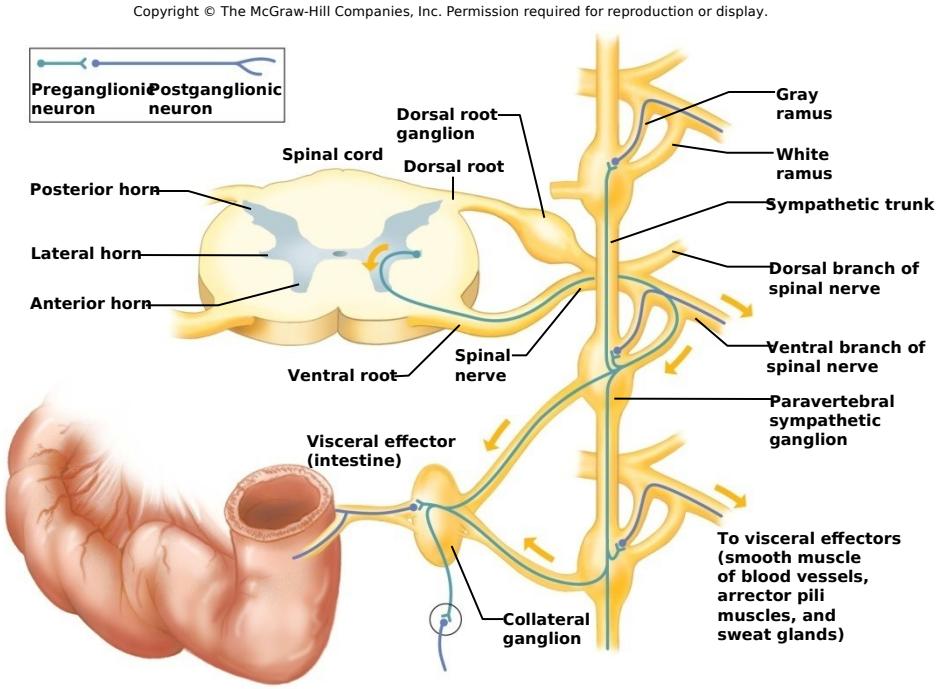


Sympathetic Division

- Postganglionic fibers extend from sympathetic ganglia to visceral organs
- Postganglionic fibers usually pass through gray rami and return to a spinal nerve before proceeding to an effector
- Exception: preganglionic fibers to adrenal medulla do not synapse with postganglionic neurons



Sympathetic Division

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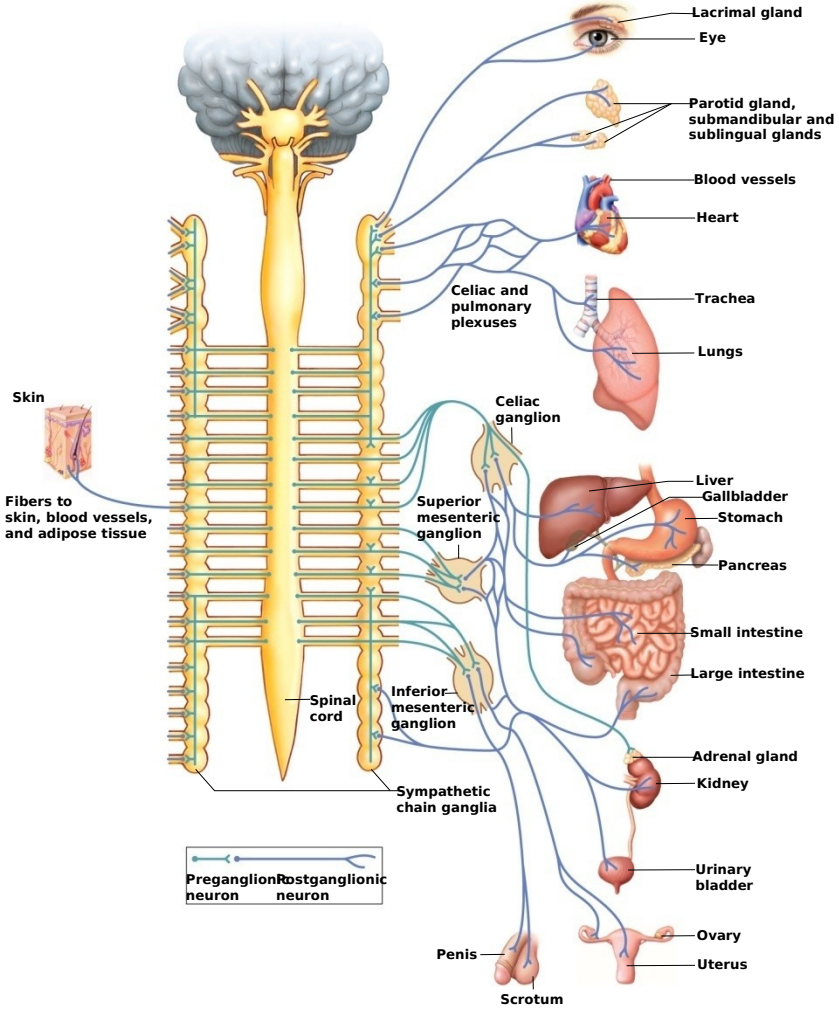

Parasympathetic Division

- Craniosacral division – location of preganglionic neurons
- Ganglia are near or within various organs
  - Terminal ganglia
- Short postganglionic fibers
  - Continue to specific muscles or glands

- Preganglionic fibers of the head are included in nerves III, VII, and IX
- Preganglionic fibers of thorax and abdomen are parts of nerve X

Parasympathetic Division

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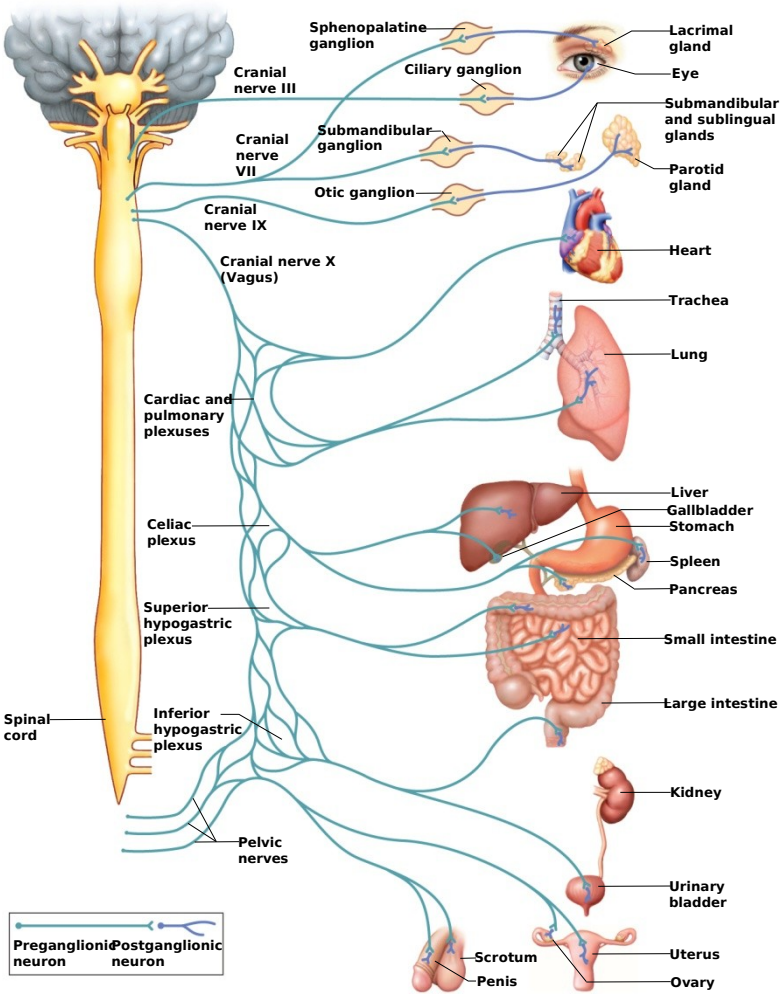

Autonomic Neurotransmitters

- Cholinergic fibers
  - Release acetylcholine
  - Preganglionic sympathetic and parasympathetic fibers
  - Postganglionic parasympathetic fibers
- Adrenergic fibers
  - Release norepinephrine
  - Most postganglionic sympathetic

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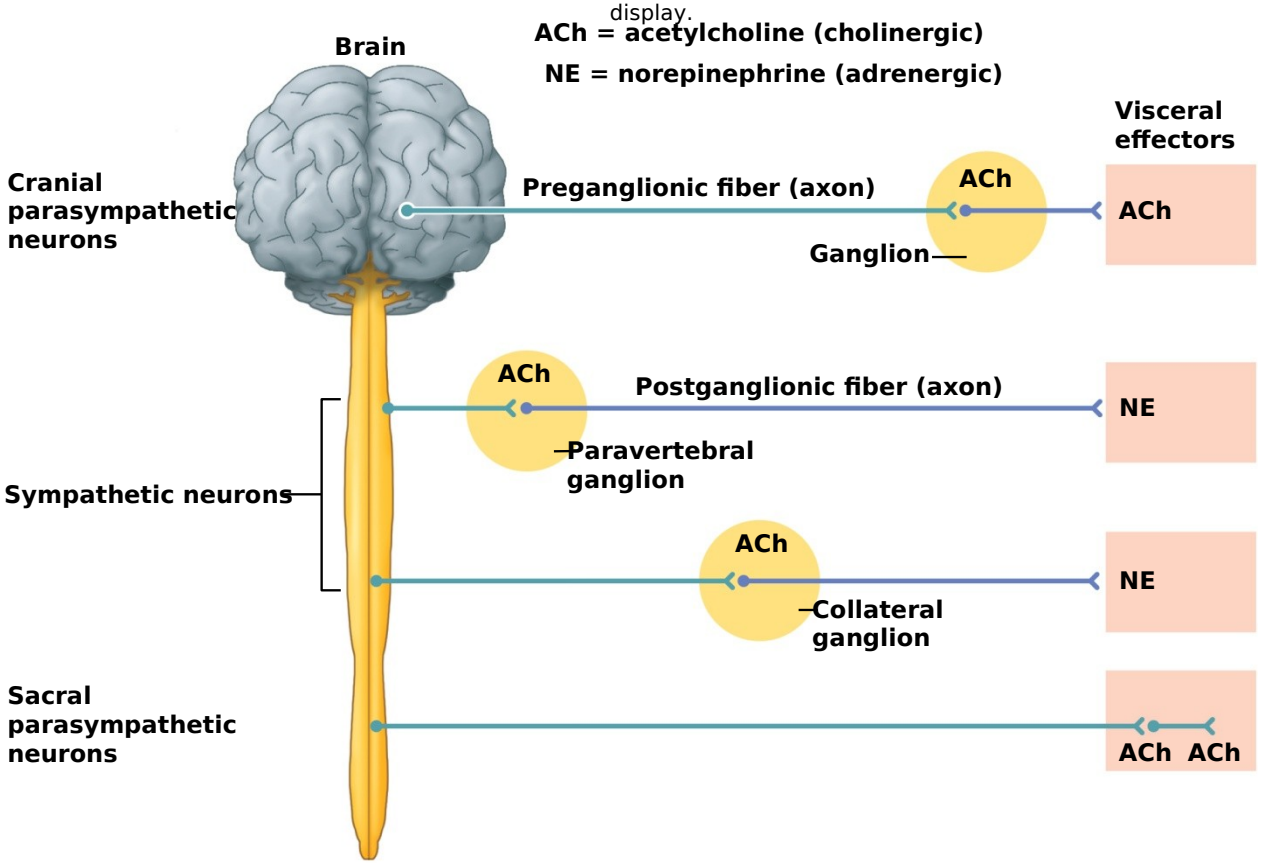

Actions of Autonomic Neurotransmitters

- Result from binding to protein receptors in the membrane of effector cells:

- Cholinergic receptors
  - Bind to acetylcholine (Ach)
  - Muscarinic
    - Excitatory
    - Slow
  - Nicotinic
    - Excitatory
    - Rapid
- Adrenergic receptors
  - Bind to epinephrine and norepinephrine
  - Alpha and beta
    - Both elicit different responses on various effectors

Terminating Autonomic Neurotransmitter Actions

- The enzyme acetylcholinesterase rapidly decomposes the acetylcholine that cholinergic fibers release.

- Norepinephrine from adrenergic fibers is removed by active transport.

Control of Autonomic Activity

- Controlled largely by CNS

- Medulla oblongata regulates cardiac, vasomotor and respiratory activities

- Hypothalamus regulates visceral functions, such as body temperature, hunger, thirst, and water and electrolyte balance

- Limbic system and cerebral cortex control emotional responses

11.8: Lifespan Changes

Brain cells begin to die before birth
Over average lifetime, brain shrinks 10%
Most cell death occurs in temporal lobes
By age 90, frontal cortex has lost half its neurons
Number of dendritic branches decreases
Decreased levels of neurotransmitters
Fading memory
Slowed responses and reflexes
Increased risk of falling
Changes in sleep patterns that result in fewer sleeping hour